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AUTHOR Mann, Karen V.; Sullivan, Patricia L.
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ABSTRACT

This study sought to determine the effectiveness of systematically designed instructional programs in helping adult hypertensives to achieve and maintain dietary sodium intake. Sixty-six subjects were randomly allocated to one of three groups: task-centered instruction; task-centered instruction plus goal-setting and self-monitoring; or control. The investigator met each subject individually, weekly for six sessions, and once again, three months following the intervention. Testing occasions occurred at study entry, immediately following the intervention, and at the three-month follow-up visit. Dependent variables were scores on a criterion-referenced achievement test, 24-hour recall of dietary intake and 24-hour urniary sodium excretion. Analysis revealed a statistically significant effect of both instructional programs, and a small, but significant, deterioration in performance during the follow-up period. There was no apparent difference in the effect of the two programs. Significant cognitive changes were achieved and maintained throughout the follow-up. Perceptions of task-related self-competence, family support and efficacy of the intervention did not add significantly to explanation of the outcomes. It is concluded that systematically designed instructional programs may be successfully applied in changing health-related behavior. (JD)

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EFFECT OF TASK-CENTERED INSTRUCTIONAL PROGRAMS ON HYPERTENSIVES' ABILITY TO ACHIEVE AND MAINTAIN REDUCED DIETARY SODIUM INTAKE

KAREN V. MANN, R.N., Ph.D.

PATRICIA L. SULLIVAN, R.N., Ph.D.

DALHOUSIE UNIVERSITY, HALIFAX, NOVA SCOTIA

CANADA

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A B S T R A C T

The study objective was to determine the effectiveness of systematically designed instructional programs in helping adult hypertensives to achieve and maintain reduced dietary sodium intake. Sixty-six men and women, aged 20-78 years, were randomly allocated allocated to one of three groups: task-centered instruction; task-centered instruction plus goal-setting and self-monitoring, or control. The instructional programs were developed specifically for the study, utilizing a frame-work of Bandura's social learning theory, the Precede Model of health education, Glaser's model of the instructional process and Gagné's task analysis instructional theory. The investigator met each subject individually, weekly for six sessions, and once again, three months following the intervention. Testing occasions occurred at study entry, immediately following the intervention, and at the three month follow-up visit. Dependent variables were scores on a criterion-referenced achievement test, 24-hour recall of dietary intake and 24-hour urinary sodium excretion. Multivariate analysis of covariance revealed a statistically significant effect of both instructional programs ($p =< 0.001$), and a smaller, but statistically significant deterioration in performance during the follow-up period ($p =< 0.05$). There was no apparent difference in the effect of the two programs. Significant cognitive changes were achieved and maintained throughout follow-up. There was also a statistically significant treatment effect on diastolic blood pressure ($p =< 0.01$). Perceptions of task-related self-competence, family suport and efficacy of the intervention did not add significantly to the explanation of outcomes. It may be concluded that systematically designed instructional programs may be successfully applied to the achievement of change in health-related behavior.

Introduction and Purpose of Study

From its earliest beginnings, the goal of patient education has been to help patients understand and cooperate with medical care, a goal shared with students of compliance and behavioral medicine. In the context of acute illnesses, and patients who presumably wished to get well, such cooperation and compliance were both desirable and expected.

Over recent decades, chronic illness has emerged as the major cause of death and disability among Canadian adults, necessitating role changes for both the patient and patient education. Typically subject to control but not cure, chronic illnesses generally require ongoing, sometimes life-long management. Accordingly, patients who must learn to live with chronic disease must commit themselves to adhering to medical advice for extended periods of time. Moreover, to function optimally, the individual with a chronic illness is expected to actively participate in and assume varying degrees of responsibility for management of the disease.

The problems of adhering to medical advice are not new. It has long been recognized that failure to comply with recommended therapy is a major factor in treatment failure. For more than fifteen years, the literature has burgeoned with reported attempts to describe, explain and predict both compliance and non-compliance (Haynes, Taylor and Sackett, 1979). Despite intensive study of these complex phenomena much remains to be determined about the most effective means of improving adherence. In addition, lack of appropriate use of theory and empirical knowledge from

the disciplines of education and psychology has diminished the impact and success of many interventions.

Many patient education programs have been directed at increasing patient knowledge, on the assumption that behavior change will naturally follow. Empirical support for such an assumption has been meagre, suggesting that knowledge may be a necessary but not sufficient condition for behavior change. Further, patient education programs have frequently neither made clear exactly which knowledge and skills the patient needs for regimen management, nor the method by which content was derived. Moreover, although patient education and programs aimed at changing health-related behaviors have achieved reasonable success in the initiation of change, evidence of successful maintenance of change is disappointing (Stuart, 1982). Clearly, there is a need for educational programs that are well designed to impart knowledge and to translate that knowledge into behavior that will be maintained over time.

Hypertension, or high blood pressure (HBP), is a major cardiovascular risk factor affecting many thousands of Canadians and Americans. Treatment, usually life-long, is beneficial, and includes both medication and/or lifestyle changes. HBP exemplifies problems in initiation and long-term maintenance of difficult behavior change, and the importance of active patient participation in disease management.

Non-pharmacologic measures are gaining importance in treating HBP, both prior to instituting long-term drug therapy, and as an adjunct to medication. Although not universally

effective, reduction of dietary sodium is widely recommended. To accomplish this, individuals require task relevant instruction to permanently modify long-standing behaviors related to their sodium intake.

Reduction of dietary sodium in hypertension constitutes a relevant and clear illustration of a change thought to be important in both preventing and controlling the progress of disease, and in enhancing treatment benefits. It entails difficult changes in long-standing and valued dietary habits, changes which must be integrated into current lifestyles and which must be maintained indefinitely.

The purpose of this study was to determine the effectiveness of systematically designed, task-centered instuctional programs for adult hypertensives. Specifically, the programs were designed to effectively teach hypertensives the knowledge, attitudes and skills relevant to the task of reducing, and maintaining reduced dietary sodium intake; and to change their behaviors to enable them to reduce their dietary sodium intake, and to maintain it, over a three month period.

The major study hypotheses were:

1. Hypertensive adults who receive a task-centered program of instruction will achieve and maintain significantly greater increases in knowledge related to reducing dietary sodium, and significantly greater reduction in dietary sodium intake than a control group receiving no specific instruction on dietary sodium intake.
2. Hypertensive adults who receive a task-centered program of

instruction, with task-relevant goal setting and self monitoring , will achieve and maintain both significantly greater increases in knowledge related to reducing dietary sodium and significantly greater reduction in dietary sodium intake than individuals receiving the task-centered instruction only, or those receiving no specific instruction.

In addition, based upon existing theoretical and empirical knowledge relating to the major hypotheses, the following secondary hypotheses were formulated:

1. Documented reductions in dietary sodium intake wil be positively associated with improved BP control.
2. Hypertensive adults holding positive perceptions of competence related to reducing dietary sodium will achieve and maintain significantly greater reduction in dietary sodium intake than either those who are unsure of their competence, or those who hold negative perceptions of their task-related competence.
3. Hypertensive adults who perceive the presence of family support related to reducing dietary sodium will achieve and maintain significantly greater reduction in dietary sodium intake than those who perceive family support to be absent.
4. Hypetensive adults who perceive reduction of dietary sodium intake as likely to benefit their BP control will achieve and maintain significantly greater reduction in dietary sodium intake than those who do not perceive the intervention as efficacious.
5. Hypertensive adults expressing positive attitudes toward

following dietary advice in specific settings (i.e. restaurant eating and eating at a friend's home) will achieve and maintain significantly greater reduction in dietary sodium intake than those who express negative attitudes.

Theoretical Framework

The theoretical framework combined four components: Bandura's Social Learning Theory (SLT) (1977); The Precede Model of Health Education (Green et al, 1980); Glaser's Model of the Instructional Process (1962), and Gagné's Task Analysis Instructional Theory (1970). Assuming man's ability to use symbols, to learn vicariously and to self-regulate behavior, SLT postulates a dynamic interaction of personal, situational and behavioral determinants in explaining behavior. The Precede Model presents a systematic approach to program planning and evaluation acknowledging the modifying effects of personal and environmental factors. Combining SLT and the Precede Model, instructional intervention was directed at personal determinants so that the individual might gain greater self-control of behavior in relation to the natural environment. Glaser's Model as a conceptualization of the instructional process was used to operationalize the concepts of SLT and the Precede Model into the two experimental instructional treatments used in the study. Further development of the components of the instructional process followed Gagné's task analysis instructional theory.

Instructional Programs

Instructional objectives for the programs were developed to represent the critical tasks involved in learning to control

or manage dietary sodium intake. Additional objectives were developed to incorporate the SLT processes of goal setting and goal-relevant self-monitoring. Task analysis was performed for each objective to identify both the prerequisite and terminal skills required for the achievement of objectives and the type of learned capability which constituted each level of the objective. Conditions of learning which would enhance achievement of the instructional objectives were then identified. Entering behaviors were assessed to record the existing perception, knowledge, skills and current behavior of the learners in relation to the instructional objectives, prior to the instructional program. The instructional procedures were developed to follow the learning hierarchy identified in the task analysis. Conditions of learning were applied to the design of instruction so that instructional activities promoted learning of the specific identified capability. The instructional programs which resulted were designed to be delivered verbally, on a one-to-one basis, over six weekly sessions. Performance assessment following the instructional program recorded the terminal perceptions, knowledge, attitudes and skills of the learners in relation to dietary sodium intake as identified in the instructional objectives and the task analysis.

Method

Sixty-six subjects, aged 18- 70 years were admitted to the study, and after stratification by age and food preparation status, were randomly assigned to one of three treatment groups: (1) task-centered instruction; (2) task-centered instruction

which included task-relevant goal-setting and self-monitoring; and (3) control.

Measurement

Three major measurements were used in the study: an achievement test on dietary sodium; 24 hour dietary recall; and 24 hour urinary sodium determination. Measures of body weight and blood pressure were also taken on each testing and treatment occasion.

Achievement test

Two equivalent forms of a 30 item criterion-referenced, objective-type achievement test were developed for the study. Pilot testing for stability (r = .77) and equivalence (r =.70) was conducted prior to use in the main study.

24-Hour Dietary Recall

Subjects reported their dietary intake for the 24 hour period preceding each testing occasion. These data were collected by dieticians whose interrater reliability approximated 91%. The dietary recall data were subjected to computer analysis for sodium content using the NUTS program (1985). In combination with the objective measure of salinity of 24-hour urine, self-report of dietary sodium is considered to provide an acceptable indicator of change (Omvik et al., 1983).

24 - Hour Urinary Sodium

Subjects collected total urinary output for two consecutive 24-hour periods at each testing occasion. Measurement of 24-hour urinary sodium output is accepted as a valid measure of dietary sodium intake (Liu et al., 1979). Analysis of the urine

specimens for creatinine served as a measure of completeness of each subject's collection.

Procedure

After assignment to the study groups, each subject was pretested using one form of the achievement test, 24-hour dietary recall, and 24-hour urinary sodium determination. Additionally, body weight and blood pressure were measured. Subjects in the experimental groups were seen weekly for six weeks and received the instructional treatments, on a one-to-one basis, from the principal investigator. All control group subjects were seen by the principal investigator on the same schedule to control for experimenter attention. Six weeks after study entry, and three months later, all three groups were posttested on an alternate form of the achievement test and with the other measures used on the pretesting occasion.

Design

A randomized, three group, three phase repeated measure design was used. Independent variables were: (1) task-centered instruction; and (2) task-centered instruction which included task-relevant goal-setting and self-monitoring. Dependent variables were: (1) scores on a criterion-referenced achievement test, (2) 24-hour dietary sodium self-report scores; and (3) 24-hour urinary sodium scores based on two consecutive determinations. Three covariates were also included in the design. These were 1) perceptions of task-related self-competence, 2) perceptions of family support in relation to the task and 3) perceptions of the usefulness of the intervention. In addition blood pressure and weight were measured. All measures were taken at pretest,

immediate posttest (following the intervention) and delayed post-test (three months following the intervention).

Results

At pretest, the groups were not significantly different from each other on any of the major dependent variables or covariates. Age and gender were similarly represented in each of the three groups.

Multivariate analysis of covariance across all dependent measures revealed an overall statistically significant treatment effect ($p = < 0.001$). A statistically significant drop-off effect was also apparent ($p = < 0.05$). Further analysis, using a univariate multiple analysis of covariance of the repeated measures design on each of the outcome measures separately, found a statistically significant treatment effect on both urinary sodium output ($p = < 0.001$) and criterion-referenced achievement test score ($p = < 0.05$). No significant treatment effect was shown on self-reported dietary sodium intake. A significant drop-off effect was demonstrated only for urinary sodium output ($p = < 0.01$) and was similar for both instructional groups. Significant cognitive changes were maintained over time. No evidence was found for a difference in effect of the two instructional treatments.

No significant effect was demonstrated of any perceptions of family support, self-competence in relation to the task, or belief in the efficacy of the intervention on the ability to change on any of the dependent variables. Nevertheless, positive affective consequences of the instructional treatments were apparent, and these were maintained over time.

Finally, although a significant treatment effect was demonstrated on diastolic BP ($P < 0.001$), none was apparent on systolic BP.

Limitations of the Study

Experimenter Effect

Changes in subject behavior are possibly attributable to the effect of the investigator. Clearly, to the extent that interaction with a health professional played a role in the treatment effect, the investigator would have exerted an influence. However, this influence should have been equally distributed across all the groups. Moreover, it would not adequately explain the control group's behavior, which was not consistent with that of the two instructional groups.

Selection Bias

Subjects in this study may have represented a highly selected population, first, from the population of hypertensives, and further from the population of those who were willing to take part in the study, who might therefore be judged to more compliant than the general population. Both factors may limit the generalizability of the results beyond this study. However, it is important to demonstrate the efficacy of such an instructional program in actually changing behavior, and this clearly must be accomplished with subjects who will comply with the protocol. Additional testing of this program on larger numbers of hypertensives can now proceed on the basis that the program has demonstrated effectiveness. Additonally, similarly developed programs may be applied to other lifestyle behaviors to further test their efectiveness.

Lack of Blinding

The study design made a double-blind condition impossible

to achieve. However, subjects were unaware that they were receiving treatment which differed from others, as all subjects were dealt with individually. In instructional interventions, however, even if blinding of the instructor were possible, it would greatly diminish if not entirely vitiate the ability to deliver instruction effectively. The fact that all dependent variable measures were carried out by blinded observers would help to offset lack of blinding in program delivery.

Limitations Induced by Measures

Less than ideal test reliabilities, large intraindividual and interindividual variation in measures of urinary sodium excretion, and demonstrated inconsistencies of the self-report measures may have combined to obscure or diminish evidence of true change in behavior, and of relationships of dietary sodium intake and BP. Similar problems have been encountered in may instances of attempts to establish intrapopulation correlations (Liu, et al., 1979; Beaton et al., 1979).

Ceiling Effect

Approximately on third of subjects claimed to have already made reductions in dietary sodium intake. This may have resulted in diminished ability to make change in the desired direction, due to the additional changes required being sufficiently difficult as to outweigh the benefits perceived or accrued.

Implication of Program Effects for Theory

The study results provided strong support for the theoretical framework conceptualized for this study.

SLT provided a broad, dynamic framework for understanding

instruction based on the task, allowed productive use of individually relevant antecedent and consequent determinants, and promoted successful goal achievement, thereby fostering perceptions of success and enhancing the individual's self-regulatory ability. Instructional design brings a systematic approach to motivation and task performance which is key to both goal and social learning theoretical approaches.

The instructional programs developed and tested in the study were demonstrated to be effective educational products. This result adds support to a systematic approach to the design of instruction, which advocates the use of a conceptualization of the instructional process, incorporating instructional objectives, entry behavior assessment, instructional procedures, and performance assessment. This conceptualization serves two functions: (1) it provides a framework within which learning theory, instructional theory and psychological concepts and principles (e.g. SLT, Gagné's task-analysis instructional theory) can be applied in order to improve educational practice; and (2) it usually results in an effective educational product.

Implications of Program Effects for Practice

The study results clearly demonstrated that a systematically developed instructional program designed to assist hypertensive individuals to reduce their dietary sodium intake, and to increase their knowledge related to that task, can achieve that goal.

In the case of sodium restriction in hypertension, the desired outcome is improved BP control. The study findings suggested that this was indeed the case. Changes in diastolic BP have

behavior and promoting behavior change. However, its complex nature necessitated a systemic operationalization of the many constructs. Use of the Precede model aided clarification of which specific determining factors which were to be addressed, and provided a perspective concerning both causes and effects of change in health-related behavior.

It was the application of instructional theory, however, which enabled the development of a specific instructional program which would achieve the desired outcomes. Within the SLT framework, Glaser's model was used to operationalize the constructs of SLT, and to examine the existing personal, social, and behavioral determinants so that specific behavioral objectives could be set. Task analysis of each objective outlined the component knowledge and skills, providing a guideline for assessment of both specific determinants affecting the individual learner, and entering behavior in relation to program objectives. Application of instructional theory, following Gagné's task analysis instructional theory, ensured a systematic approach to each cognitive, affective and psychomotor skill involved in achieving the instructional objective, and the promotion of effective use of man's symbolic, information-processing and self-regulation skills. Finally, performance assessment assured that behavioral capability had been achieved.

Instructional and goal theory combined to promote the success of the goal-setting intervention. Goal theory provided guidelines for the most effective types and conditions of goal-setting. Setting of task-related goals, and provision of goal-relevant

both statistical and clinical significance. Diastolic BP's in both instructional groups fell below 90 mmHg, a widely accepted upper level of normal BP (Canadian Hypertension Society, 1982). Even should relationships between dietary sodium and BP be discounted ultimately, there exist other disease conditions which necessitate sodium restriction, and for which an effective educational program would be necessary.

Of greater importance, however, is the observation that a similar approach may be applied in developing programs which address other lifestyle changes. Findings in this study support that such programs can maintain the interest and improve the performance of all levels of learners.

Recommendations for Further Research

Based upon the study findings, the following suggestions for further research are offered.

1) Further examination of the effects of both task-centered instruction, and task-centered instruction plus goal-setting and self-monitoring, should be carried out to determine the exact nature of the difference in their effects on cognition and task performance. Specifically, when added to the task-centered instruction, has the goal-setting and self-monitoring an additive effect, or is the character of the task-centered instruction substantively altered?
2) Programs utilizing the same theoretical framework should be developed, to test the effectiveness of this approach in changing other health-related behaviors.
3) Further test development should focus upon the development

of instruments which will be a valid and reliable test of affective as well as cognitive skills required in health-related behavior.

4) The process of active monitoring by a health care professional should be studied to determine its role in the maintenance of newly acquired behavior.

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